

WHAT IS CLAIMED IS:

1. A video encoding apparatus to encode a video,
comprising:

an input picture module configured to receive
5 an input picture;

a memory to store a reference picture;

a motion vector detection module configured to
detect a motion vector of the input picture in units
of a macroblock by block matching referring to the
10 reference picture; and

a predictive encoding module configured to
perform forward predictive encoding and bidirectional
predictive encoding in units of a macroblock using the
motion vector and the reference picture, to generate
15 a forward predictive encoded picture and at least one
bidirectional predictive encoded picture which is
inputted between the forward predictive encoded picture
and the reference picture, the predictive encoding
module skipping a macroblock of the forward predictive
20 encoded picture in a variable length encoding when
a correlation between the macroblock of the forward
predictive encoded picture and macroblocks of the
bi-directional predictive encoded picture and the
reference picture which are located at the same
25 position as that of the forward predictive encoded
picture is high.

2. The video encoding apparatus according to

claim 1, which includes an orthogonal transformation module configured to subject each macroblock to orthogonal transformation and quantization to generate quantized orthogonal transformed coefficients, and
5 wherein the predictive encoding module skips macroblocks of the forward predictive encoded picture that satisfy following conditions:

(a) forward motion vectors of the macroblocks of all bidirectional predictive encoded pictures using the
10 reference picture which is the same as that used for the forward predictive encoded picture are 0, and

(b) matching residuals with respect to the macroblocks of all the bidirectional predictive encoded pictures that are at the same position are not more
15 than a threshold,

3. The video encoding apparatus according to claim 2, wherein the predictive encoding module performs a forward motion vector detection of each of the macroblocks of all bidirectional predictive encoded
20 pictures subjected to the forward motion vector detection by using the reference picture, before a variable length encoding of the macroblock of the forward predictive encoded picture that is located at the same position as those of the bidirectional
25 predictive encoded pictures.

4. The video encoding apparatus according to claim 1, wherein the motion detection module carries

out a forward motion vector detection of the
macroblocks of all bidirectional predictive encoded
pictures that are located at the same position as
that of the reference picture before variable length
5 encoding of the macroblock of the forward predictive
encoded picture, and the encoding module includes a
variable length encoder to subject each macroblock of
each of the pictures to variable length encoding.

5. A video encoding mode converting apparatus
10 comprising:

an encoding mode conversion module configured to
convert first encoded video data of a first encoding
mode into second encoded video data of a second
encoding mode, the first encoded video data and the
15 second encoded video data each including an intraframe
encoded picture, a forward predictive encoded picture
and a bidirectional predictive encoded picture; and

an encoding module configured to skip a macroblock
of the forward predictive encoded picture of the second
20 encoding mode that satisfies following conditions:

(a) all macroblocks of all bidirectional
predictive encoded pictures subjected to a forward
motion vector detection referring to a reference
picture used for the forward predictive encoded
25 picture, the all macroblocks being located at the same
position as that of the forward encoded picture are
skipped, or

(b) forward motion vectors of the all macroblocks corresponding to the same position are 0, and the number of blocks making the macroblock and changing with respect to the reference picture is 0.

5 6. A video encoding mode converting apparatus according to claim 5, which includes:

 an input module to input encoded data of a first encoding mode including an intraframe encoded picture and a forward predictive encoded picture and a
10 bidirectional predictive encoded picture;

 an information acquirement module configured to acquire information representing a motion vector, an encoding mode and the number of blocks making the macroblock and changing with respect to a macroblock of
15 a reference picture; and

 a mode determination module configured to determine an encoding mode of each macroblock that satisfies the conditions (a) and (b) when encoding each macroblock in the second encoding mode according to the
20 information representing the motion vector and the encoding mode.

 7. A video encoding mode converting apparatus comprising:

 a decoder to decode encoded data of a first
25 encoding mode including an intraframe encoded picture, a forward predictive encoded picture and a bidirectional predictive encoded picture to output

decoded data;

5 a mode determination module configured to
determine an encoding mode of each macroblock when
encoding each macroblock in a second encoding mode
according to information obtained from the decoder, the
information representing a motion vector, an encoding
mode and the number of macroblocks changing with
respect to a reference picture; and

10 a variable length encoder to encode picture data
provided from the decoder in the second encoding mode
every macroblock according to a determination result of
the mode determination module,

15 the mode determination module determining to skip
the macroblock of the forward prediction encoded
picture in the second encoding mode according to
following conditions:

20 (a) macroblocks of all bidirectional predictive
encoded pictures encoded based on forward motion
compensation referring to the same reference picture as
that used for the forward predictive encoded picture,
the macroblocks located at the same position as that of
the reference picture, are skipped, or

25 (b) all forward motion vectors of macroblocks
corresponding to the same position and the number
of blocks having orthogonal-transformed coefficients
are 0.

8. A video encoding mode converting apparatus

comprising:

a mode converter to convert video encoded data of a MPEG-2 mode into video encoded data of a MPEG-4 mode; and

5 an encoder to encode a macroblock of a P-Picture in not_coded mode when satisfying conditions (a) or (b) in the MPEG-4 mode,

(a) macroblocks of all B-Pictures encoded based on forward motion compensation referring to the P-Picture, the macroblocks located at the same position as that of the P-Picture, are skipped,

(b) all the forward motion vectors and CBPs of macroblocks of all the B-Pictures forwardly referring to the same reference picture as that used for the P-Picture are 0.

9. A video encoding method of subjecting a video to intraframe encoding, forward predictive encoding, and bidirectional predictive encoding, comprising:

detecting a motion vector of an input picture in units of a macroblock by block matching referring to a reference picture; and

performing the forward predictive encoding and bidirectional predictive encoding in units of a macroblock using the motion vector and the reference picture, to generate a forward predictive encoded picture and at least one bidirectional predictive encoded picture which is inputted between the forward

predictive encoded picture and the reference picture,
the predictive encoding module skipping a macroblock of
the forward predictive encoded picture in a variable
length encoding when a correlation between the
5 macroblock of the forward predictive encoded picture
and macroblocks of the bi-directional predictive
encoded picture and the reference picture which are
located at the same position as that of the forward
predictive encoded picture is high.

10 10. A video encoding method of encoding an input
video signal, the method comprising:

detecting a forward motion vector every macroblock
of a to-be-encoded picture using as a reference picture
an intraframe encoded picture or a first forward
15 encoded picture just before the to-be-encoded picture
to generate a second forward predictive encoded picture
and bidirectional predictive encoded pictures;

subjecting pixel values of the macroblock of the
to-be-encoded picture to an orthogonal transformation
20 every macroblock and quantizing the orthogonal-
transformed coefficients;

skipping the macroblock of each of the forward
predictive encoded picture and the bidirectional
predictive encoded pictures in a variable length
25 encoding when satisfying following conditions:

(a) a forward motion vector of the macroblock of
the bidirection predictive encoded picture that is

located at the same position as the macroblock of
the to-be-encoded picture is 0, the bidirectional
predictive encoded picture subjected to a motion vector
detection using the same reference picture as that used
5 for the to-be-encoded picture, and

(b) differences between macroblocks of all the
bidirectional predictive encoded pictures as that of
the reference picture and the macroblock of the
reference picture are not more than a threshold.

10 11. A video encoding mode converting method
comprising:

converting video encoded data of a MPEG-2 mode
into video encoded data of a MPEG-4 mode; and

15 skipping a macroblock of a forward predictive
encoded picture when satisfying conditions (a) or (b) in
the MPEG-4 mode,

(a) macroblocks of all B-Pictures encoded based on
forward motion compensation referring to the P-Picture,
the macroblocks located at the same position as that of
20 the P-Picture, are skipped,

(b) all the forward motion vectors and CBPs of
macroblocks of all the B-Pictures forwardly referring
to the same reference picture as that used for the
P-Picture are 0.

25 12. A video encoding apparatus comprising:
an intraframe encoding module;
a forward predictive encoding module;

a bidirectional predictive encoding module;
an information extracting module configured to
extract specific information from an encoded result of
a first picture encoded by one of the intraframe
5 encoding module, the forward predictive encoding module
and the bidirectional predictive encoding module; and
a selection module configured to select, according
to the specific information, one of the intraframe
encoding module and the forward predictive encoding
10 module, to encode a second picture to be encoded next
to the first picture.

13. The video encoding apparatus according to
claim 12, wherein the selection module selects one of
the intraframe encoding module and the forward
15 predictive encoding module in following cases:

(a) the first frame is encoded by the forward
predictive encoding module, and

(b) the first frame is encoded by the
bi-directional encoding module and a third picture
20 inputted next to the first picture is encoded by the
forward predictive encoding module.

14. The video encoding apparatus comprising:
an intraframe encoding module;
a forward predictive encoding module;
25 a bidirectional predictive encoding module;
a computation module configured to compute the
number of encoded bits obtained by encoding a first

picture with one of the intraframe encoding module,
the forward predictive encoding module and the
bidirectional predictive encoding module;

a threshold memory to store a threshold;

5 a selection module configured to select one of the
intraframe encoding module and the forward predictive
encoding module, to encode a second picture to be
encoded next to the first picture when the number of
encoded bits of the first picture is more than the
10 threshold.

15 15. The video encoding apparatus according to
claim 14, wherein the control module includes a first
setting unit configured to set a first value to the
threshold memory when the number of encoded bits of the
first picture is more than the threshold, and

a second setting unit configured to set a second
value more than the first value to the threshold memory
when the number of encoded bits of the first picture is
less than the threshold.

20 16. The video encoding apparatus according to
claim 14, wherein the selection module selects one of
the intraframe encoding module and the forward
predictive encoding module in following cases:

(a) the first frame is encoded by the forward
25 predictive encoding module, and

(b) the first frame is encoded by the
bi-directional encoding module and a third picture

inputted next to the first picture is encoded by the forward predictive encoding module.

17. A video encoding apparatus comprising:

5 an encoding module configured to encode a video by using intraframe encoding mode, forward predictive encoding mode and bi-directional predictive encoding mode;

10 a computation module configured to compute the number of encoded bits of a code obtained by encoding the video by the encoding module; and

a presuming module configured to presume a occupancy of a VBV buffer by using the number of encoded bits, the VBV buffer being a virtual buffer of a virtual decoder side; and

15 a selection module configured to select one of the intraframe encoding mode and the forward predictive encoding mode for a second picture to be encoded next to the first picture according to the occupancy of the VBV buffer.

20 18. The video encoding apparatus according to claim 17, wherein the selection module selects the intraframe encoding mode and the forward predictive encoding mode when the occupancy of the VBV buffer is less than the threshold.

25 19. The video encoding apparatus according to claim 17, wherein the selection module selects the intraframe encoding mode and the forward predictive

encoding mode when the occupancy of the VBV buffer decreases over the first picture and a plurality of pictures before the first picture.

20. The video encoding apparatus according to
5 claim 17, wherein the selection module selects one of the intraframe encoding mode and the forward predictive encoding mode when the result of encoding of the first picture is skipped.

21. The video encoding apparatus according to
10 claim 17, wherein the selection module selects one of the intraframe encoding mode and the forward predictive encoding mode when the number of encoded bits of a motion vector of encoded data of the first picture exceeds a threshold.

22. The video encoding apparatus according to
15 claim 17, which includes an examination module configured to examine a computation load of the encoding module, and the selection module selects one of the intraframe encoding mode and the forward
20 predictive encoding mode when the computation load exceeds a threshold.

23. The video encoding apparatus according to
claim 17, wherein the selection module selects one of the intraframe encoding mode and the forward predictive
25 encoding mode in following cases (a) and (b):

(a) the first frame is encoded by the forward predictive encoding mode, and

(b) the first frame is encoded by the bi-directional encoding mode and a third picture inputted next to the first picture is encoded by the forward predictive encoding mode.

5 24. A video encoding method comprising:
 encoding each picture of a video;
 extracting a specific information from an encoded
 result obtained by encoding a first picture; and
 selecting one of a forward predictive encoding
10 mode and an intraframe encoding mode according to the
 information in encoding a second picture to be encoded
 next to the first picture.

 25. The video encoding method according to
 claim 24, wherein the selecting selects one of
15 a forward predictive encoding mode and an intraframe
 encoding mode in following cases (a) and (b):

 (a) the first frame is encoded by the forward
 predictive encoding mode, and

 (b) the first frame is encoded by the
20 bi-directional encoding mode and a third picture
 inputted next to the first picture is encoded by the
 forward predictive encoding mode.

 26. A video encoding method comprising:
 encoding each picture of a video;
25 deriving the number of encoded bits generated when
 encoding a first picture;
 comparing the number of encoded bits of the first

picture with a threshold;

selecting one of an intraframe encoding mode and
a forward predictive encoding mode for a second picture
to be encoded next to the first picture when the number
5 of encoded bits of the first picture exceeds the
threshold.

27. The video encoding method according to
claim 26, which includes setting a first value as
the threshold for next comparison when the number
10 of encoded bits of the first picture exceeds the
threshold; and setting a second value larger than the
first threshold as the threshold for next comparison
when the number of encoded bits of the first picture is
less than the threshold.

15 28. The video encoding method according to
claim 26, wherein the selecting selects one of
a forward predictive encoding mode and an intraframe
encoding mode in following cases (a) and (b):

(a) the first frame is encoded by the forward
20 predictive encoding mode,

(b) the first frame is encoded by the bi-
directional encoding mode and a third picture inputted
next to the first picture is encoded by the forward
predictive encoding mode.

25 29. A video encoding method comprising:
encoding each picture of a video;
computing the number of encoded bits when encoding

a first picture;

presuming occupancy of a VBV buffer that is
a virtual buffer of a virtual decoder side by using the
number of encoded bits, the VBV buffer being a virtual
5 buffer on a virtual decoder side; and

selecting one of an intraframe encoding mode and
a forward predictive encoding mode for a second picture
to be encoded next to the first picture, according to
a change of the occupancy of the VBV buffer.

10 30. The video encoding method according to
claim 29, wherein the selecting selects one of the
intraframe encoding mode and the forward predictive
encoding mode when the occupancy of the VBV buffer is
less than the threshold.

15 31. The video encoding method according to
claim 29, wherein the selecting selects one of the
intraframe encoding mode and the forward predictive
encoding mode when the occupancy of the VBV buffer
decreases over the first picture and a plurality of
20 pictures before it.

32. The video encoding method according to
claim 29, wherein the selecting selects one of the
intraframe encoding mode and the forward predictive
encoding mode when a result obtained by encoding the
25 first picture is "not_coded".

33. The video encoding method according to
claim 29, wherein the selecting selects one of the

intraframe encoding mode and the forward predictive encoding mode when the number of encoded bits of a motion vector of encoded data of the first picture exceeds a threshold.

5 34. The video encoding method according to claim 29, which includes examining a computation load of the encoding, and the selecting selects one of the intraframe encoding mode and the forward predictive encoding mode when the computation load exceeds the
10 threshold

 35. The video encoding method according to claim 29, wherein the selecting selects one of a forward predictive encoding mode and an intraframe encoding mode in following cases (a) and (b):

15 (a) the first frame is encoded by the forward predictive encoding mode,

 (b) the first frame is encoded by the bi-directional encoding mode and a third picture inputted next to the first picture is encoded by
20 the forward predictive encoding mode.

 36. A video encoding apparatus to encode a video by MPEG-4, comprising:

 an encoding module configured to encode each VOP (video object plane) of the video;

25 an extraction module configured to extract specific information from an encoded result of a first VOP of the video;

a control module configured to control the
encoding module to encode a second VOP to be encoded
next to the first picture as one of an intraframe
encoded picture, a forward predictive encoded picture
5 and a not_coded picture, according to the specific
information.

37. A video encoding apparatus to encode a video
by MPEG-4, comprising:

an encoder to encode each VOP (video object plane)
10 of the video;

a computation module configured to obtain the
number of encoded bits generated by encoding a first
VOP of the video;

a memory to store a threshold; and
15 a control module configured to compare the number
of encoded bits of the first VOP with the threshold,
and control the encoder to encode a second VOP to be
encoded next to the first VOP as one of an intraframe
encoded VOP, a forward predictive encoded VOP and
20 a not_coded VOP when the number of encoded bits exceeds
the threshold.

38. A video encoding apparatus to encode a video
by MPEG-4, comprising:

an encoder to encode each VOP (video object plane)
25 of the video;

a computation module configured to obtain the
number of encoded bits generated by encoding a first

VOP of the video;

a presume module configured to presume occupancy of a VBV buffer that is a virtual buffer of a virtual decoder side by using the number of encoded bits;

5 a control module configured to control the encoder to encode a second VOP to be encoded next to the first VOP as one of an intraframe encoded VOP, a forward predictive encoded VOP and a "not_coded" VOP, according to a change of the occupancy of the VBV buffer.

10 39. A video encoding method comprising:

encoding each picture of a video by MPEG-4;

extracting specific information from a result obtained by encoding a first VOP (video object plane) of the video; and

15 encoding a second picture to be encoded next to the first picture as one of a forward predictive encoded VOP, an intraframe encoded VOP and a not_coded VOP, according to the specific information.

40. A video encoding method comprising:

20 encoding each picture of a video by MPEG-4;

computing the number of encoded bits generated when encoding a first VOP (video object plane);

comparing the number of encoded bits of the first VOP with a threshold;

25 controlling the encoding to encode a second VOP to be encoded next to the first picture as one of a forward predictive encoded VOP, an intraframe encoded

VOP and a not_coded VOP, when the number of encoded bits of the first VOP exceeds the threshold.

41. A video encoding method comprising:

5 encoding each VOP (video object plane) of a video by MPEG-4;

computing the number of encoded bits generated when encoding a first picture;

10 presuming occupancy of a VBV buffer that is a virtual buffer of a decoder side, by using the number of encoded bits,

controlling the encoding to encode a second VOP to be encoded next to the first VOP as one of a forward predictive encoded VOP, an intraframe encoded VOP and a not_coded VOP, according to a change of the occupancy
15 of the VBV buffer.